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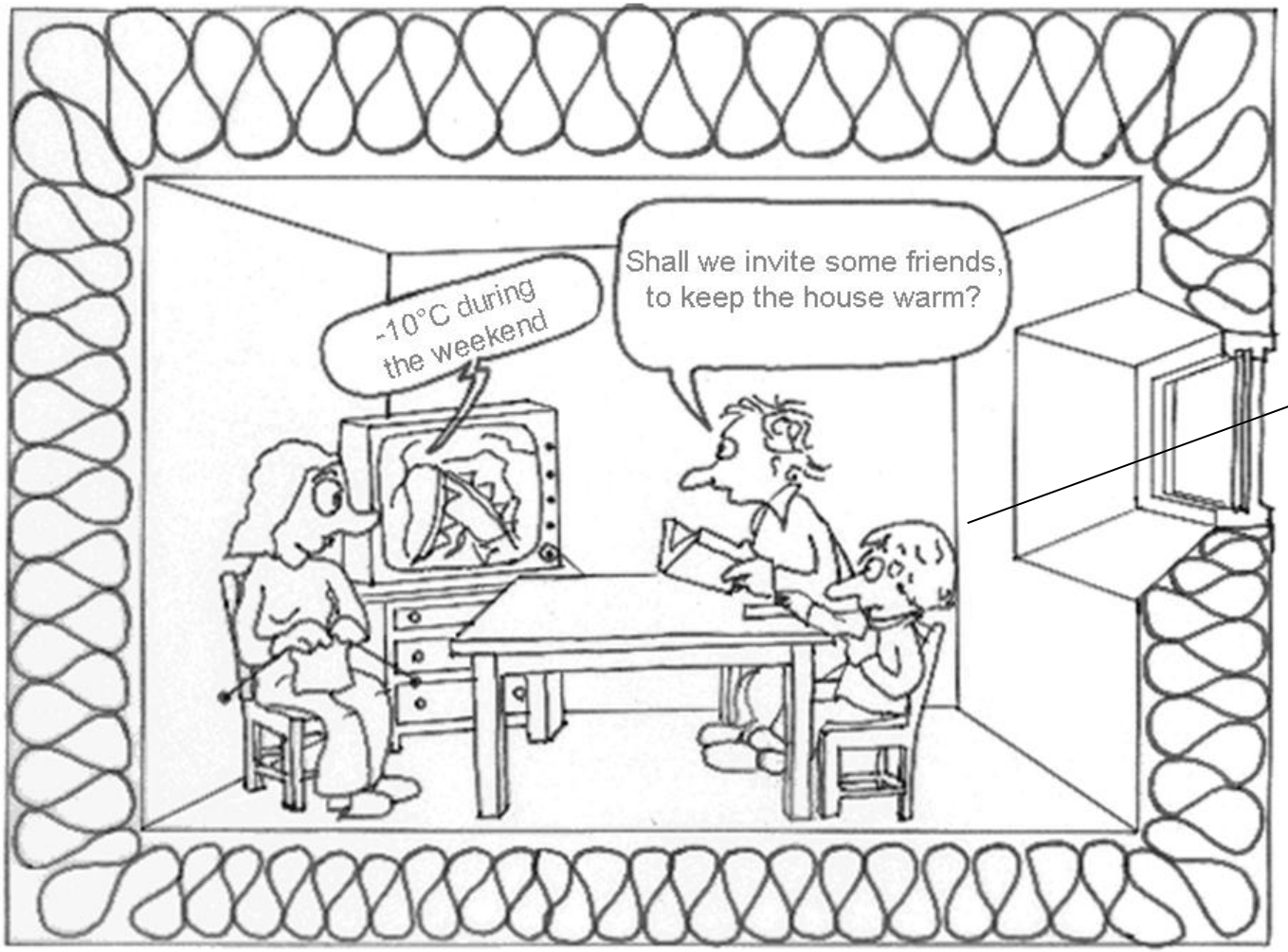
Two linked Passivahaus certified buildings -The Centre for Disability Studies

Disability Essex



"Cool, all energy efficiency and no Bling....."

"..OK, yes, I suppose we could call the MVHR frost protection system a 'ground source heat pump' ..if you need to..."

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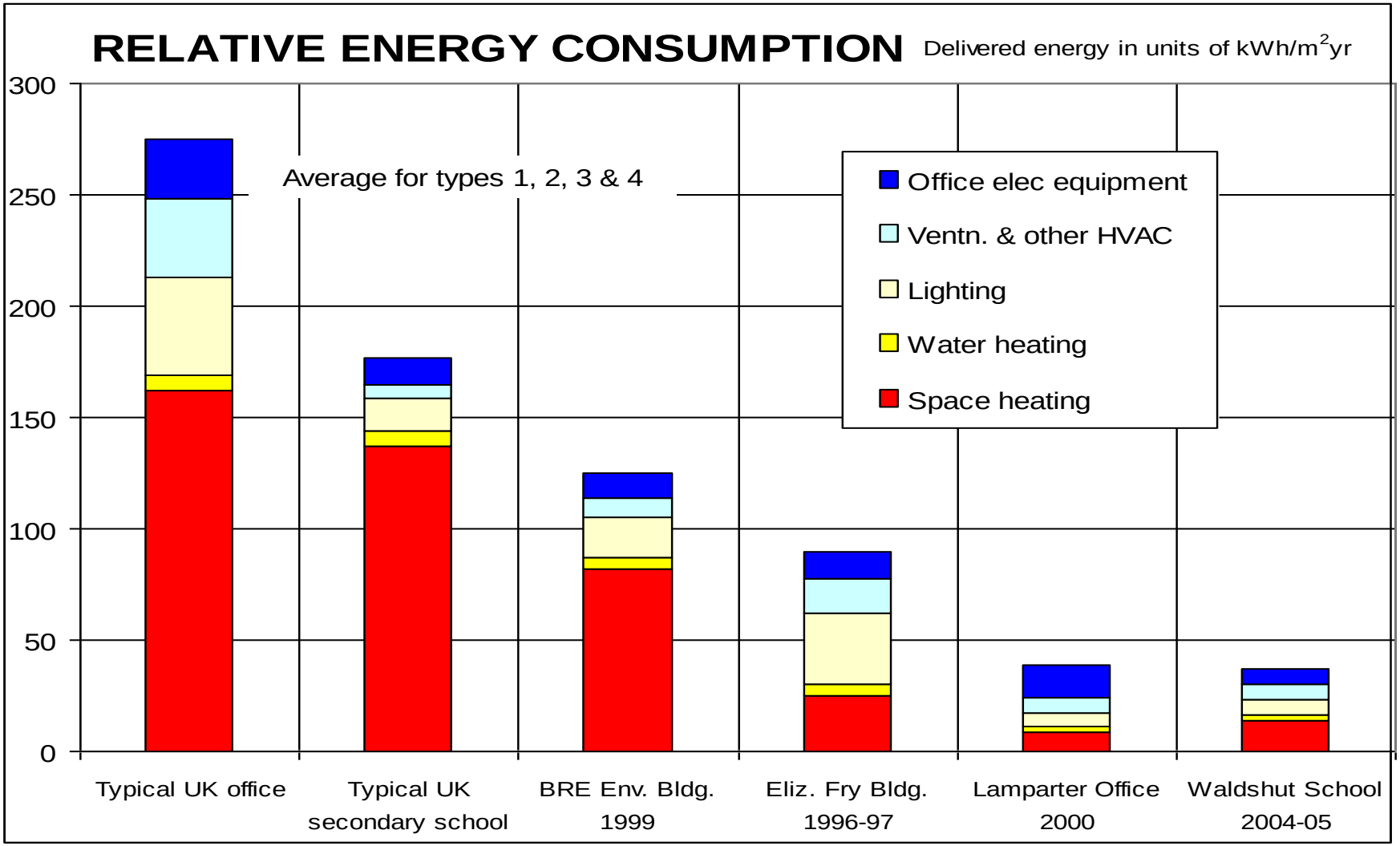
Impact of Energy Performance Standards on Non-Domestic Building Energy Use



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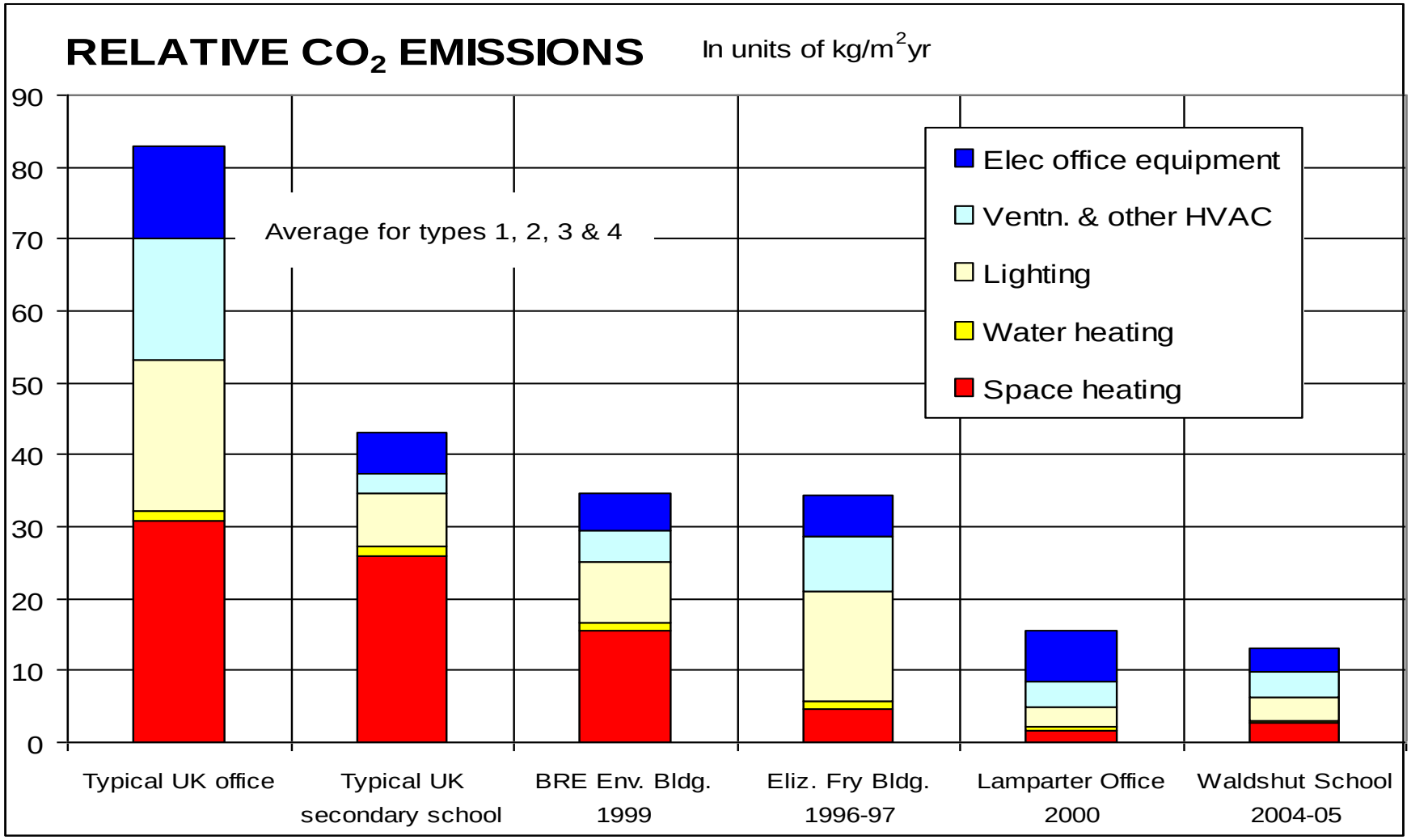
Impact of Energy Performance Standards on Non-Domestic Building CO_2 Emissions



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1. Heat demand ≤ 15 kWh/m²year [15 Wing A and 14 Wing B]

2. Airtightness: n_{50}-value ≤ 0,6 h^{-1} [Wing A&B = each 0.3]

3. Overheating ratio ≤ 10% year above 25°C [Wing A&B = 6%]

4. Primary energy ≤ 120 kWh/m²year
   [Wing A=90*, Wing B = 117*]

** Dependent on adoption of Design Team's recomendations for e.e. IT & office equipment and any domestic appliances (over time?). Seperate report to client.*

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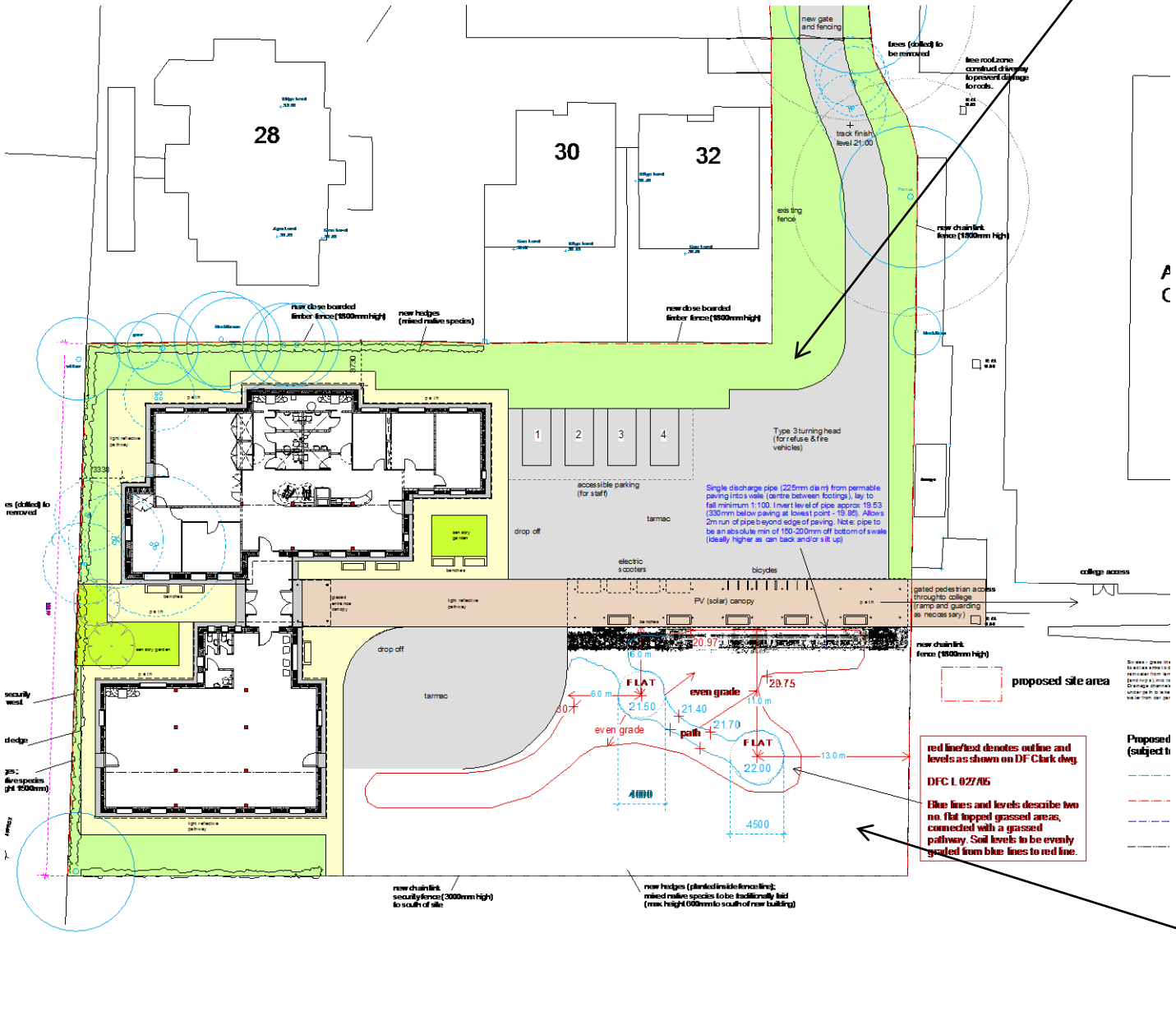
28
30
32
new gate and fencing
trees (dotted) to be removed
tree root zone construct driveway to prevent damage to roots.
track finish level 21.00
existing fence
new chainlink fence (1800mm high)
new close boarded timber fence (1800mm high)
new hedges (mixed native species)
new close boarded timber fence (1500mm high)
Type 3 turning head (for refuse & fire vehicles)
accessible parking (for staff)
tarmac
drop off
Single discharge pipe (225mm diam) from permable paving into a swale (centre between footings), lay to fall minimum 1:100. Invert level of pipe approx 19.53 (330mm below paving at lowest point - 19.85). Allows 2m run of pipe beyond edge of paving. Note: pipe to be an absolute min of 150-200mm off bottom of swale (ideally higher as can back and/or silt up)
electric scooters
bicycles
PV (solar) canopy
gated pedestrian access through to college (ramp and guarding as necessary)
college access
new chainlink fence (1800mm high)
proposed site area
FLAT
even grade
path
20.97
29.75
21.50
21.40
21.70
22.00
6.0 m
11.0 m
13.0 m
4000
4500
red line/text denotes outline and levels as shown on DF Clark dwg
DFC L 027/05
Blue lines and levels describe two no. flat topped grassed areas, connected with a grassed pathway. Soil levels to be evenly graded from blue lines to red line.
new chainlink security fence (3000mm high) to south of site
new hedges (planted inside fence line); mixed native species to be traditionally laid (max height 600mm to south of new building)

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WING A
322 sqm

WING 'S A
Lobby to be
s' standa
rd

A

D

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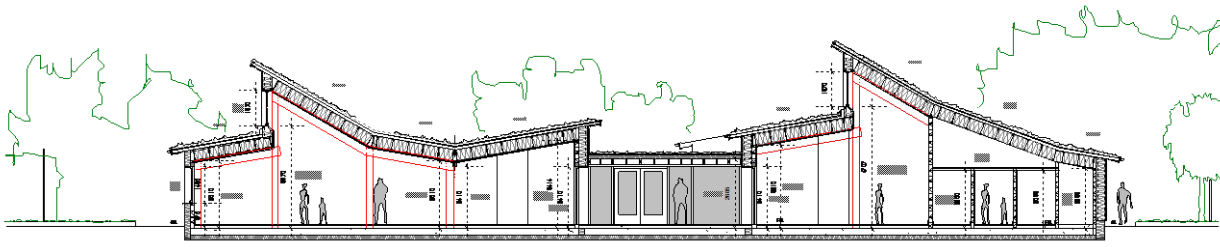


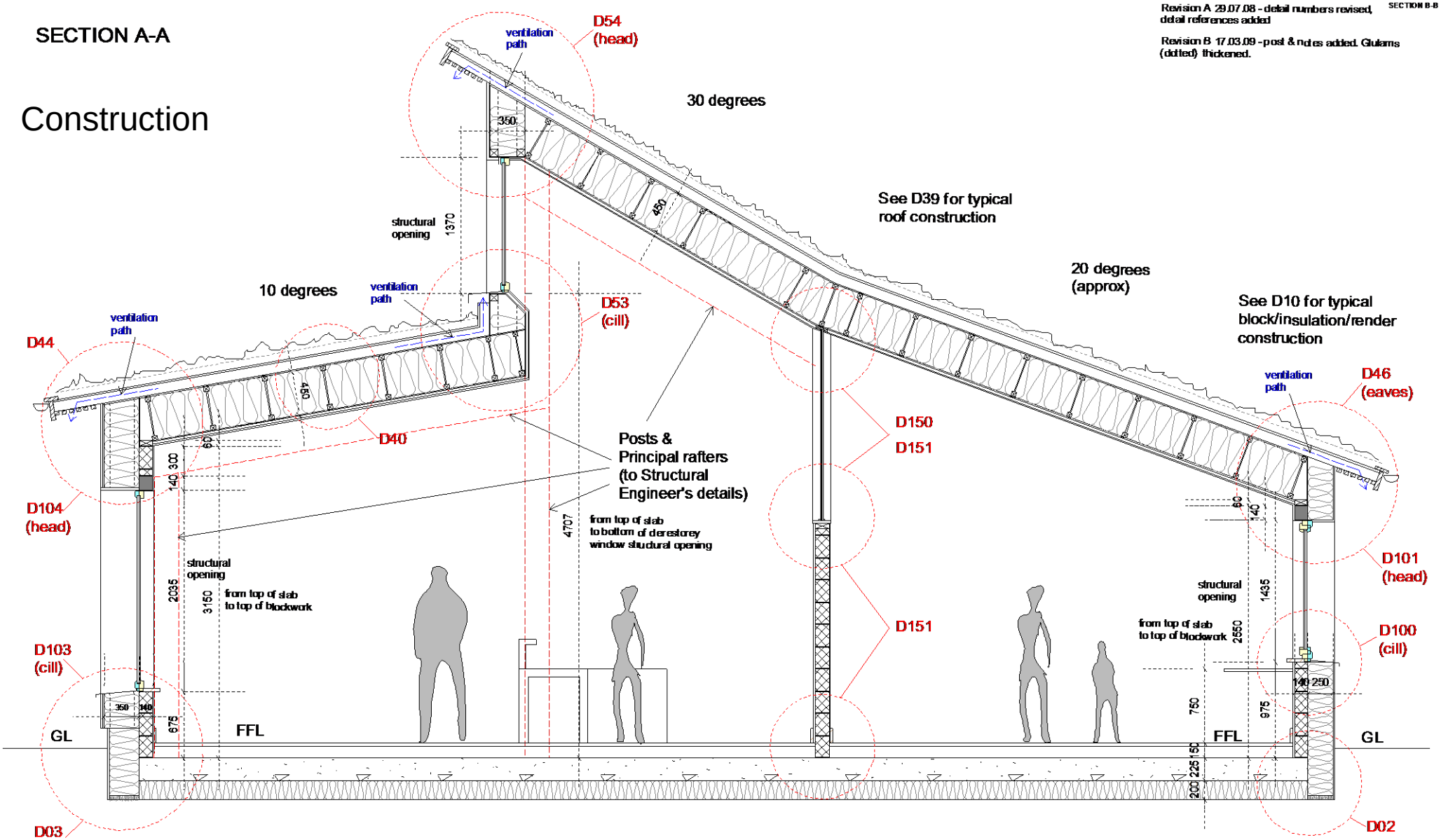
Revision A 29.07.08 - detail numbers revised, detail references added

Revision B 17.03.09 - post & notes added. Glulams (dotted) thickened.

SECTION B-B

SECTION A-A

Construction



See D11 for typical block/timber ladder studwork/timber cladding construction

THERMAL MASS: **WELL DISTRIBUTED THERMALLY MASSIVE ELEMENTS: CONCRETE & GYPSUM/CELLULOSE BOARDS**

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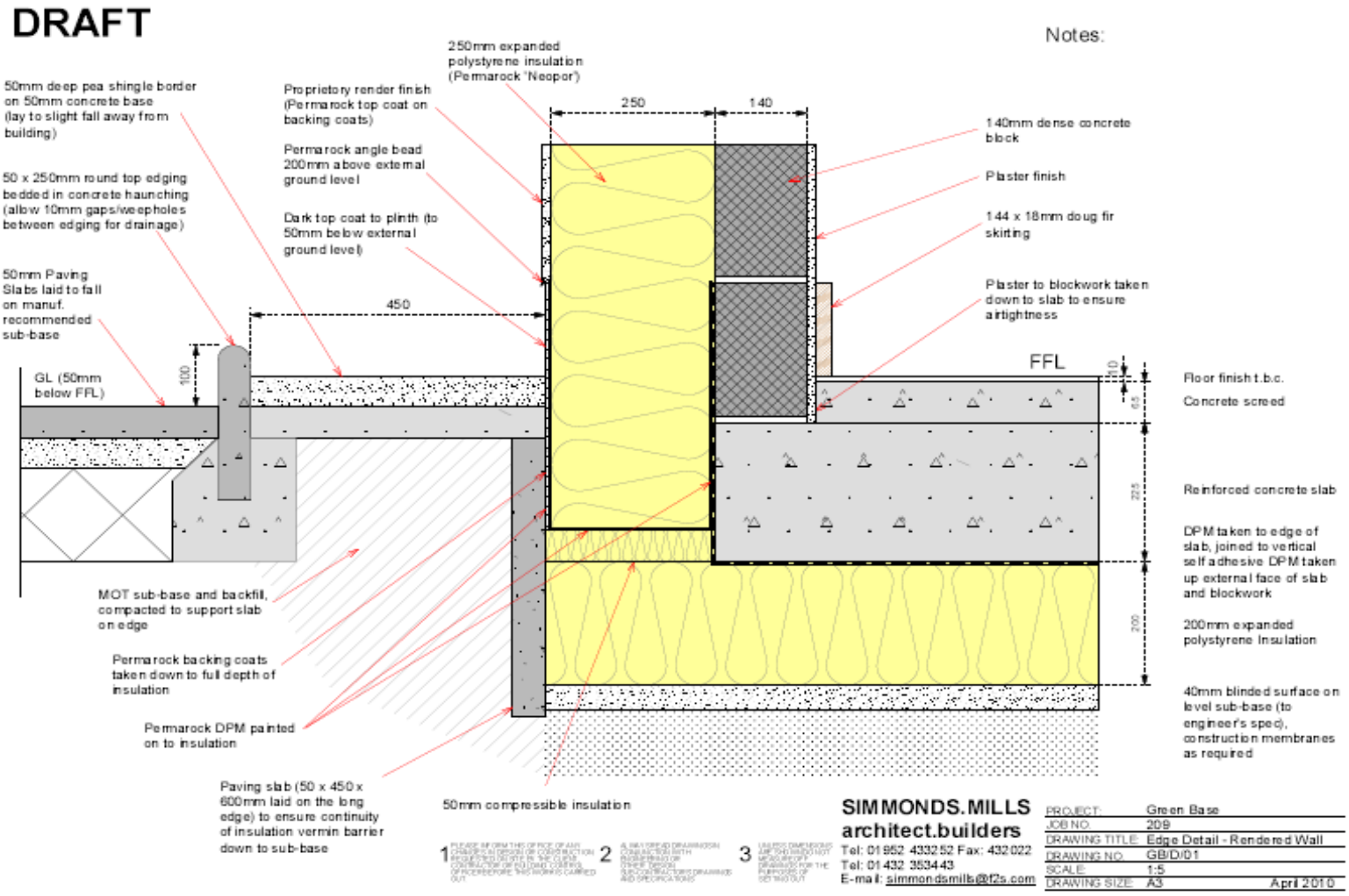
Thermal bridge free construction

≤ 0.1 W/mK [rule of thumb, c. 200mm insulation uninterupted around a junction


DRAFT
Notes:
250mm expanded polystyrene insulation (Permarock 'Neopor')
50mm deep pea shingle border on 50mm concrete base (lay to slight fall away from building)
Proprietory render finish (Permarock top coat on backing coats)
Permarock angle bead 200mm above external ground level
50 x 250mm round top edging bedded in concrete haunching (allow 10mm gaps/weepholes between edging for drainage)
Dark top coat to plinth (to 50mm below external ground level)
50mm Paving Slabs laid to fall on manuf. recommended sub-base
GL (50mm below FFL)
250
140
450
100
140mm dense concrete block
Plaster finish
144 x 18mm doug fir skirting
Plaster to blockwork taken down to slab to ensure airtightness
FFL
Floor finish t.b.c.
Concrete screed
Reinforced concrete slab
DPM taken to edge of slab, joined to vertical self adhesive DPM taken up external face of slab and blockwork
200mm expanded polystyrene insulation
40mm blinded surface on level sub-base (to engineer's spec), construction membranes as required
MOT sub-base and backfill, compacted to support slab on edge
Permarock backing coats taken down to full depth of insulation
Permarock DPM painted on to insulation
Paving slab (50 x 450 x 600mm laid on the long edge) to ensure continuity of insulation vermin barrier down to sub-base
50mm compressible insulation
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architect.builders
Tel: 01 952 433252 Fax: 432022
Tel: 01 432 353443
E-mail: simmondsmills@f2s.com
PROJECT: Green Base
JOB NO: 209
DRAWING TITLE: Edge Detail - Rendered Wall
DRAWING NO: GB/D/01
SCALE: 1:5
DRAWING SIZE: A3
April 2010

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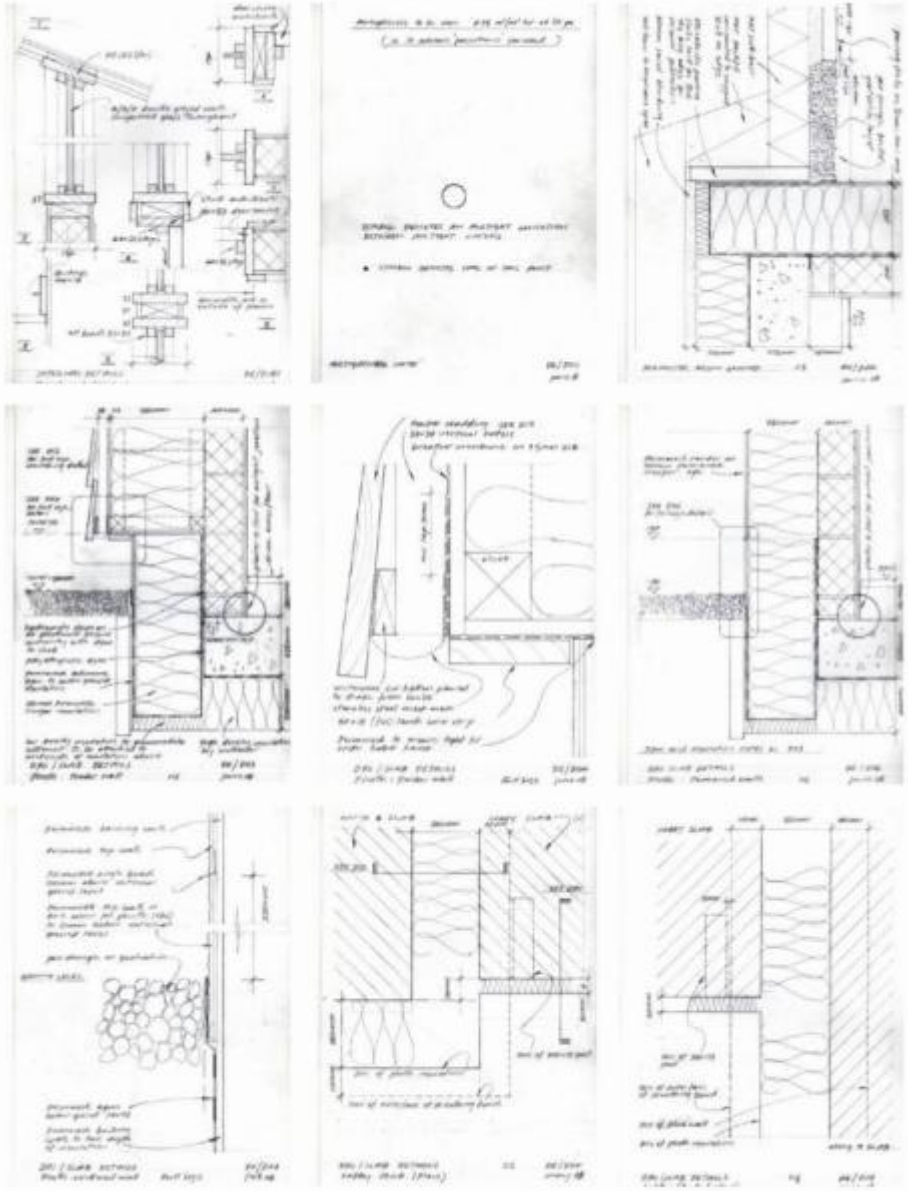

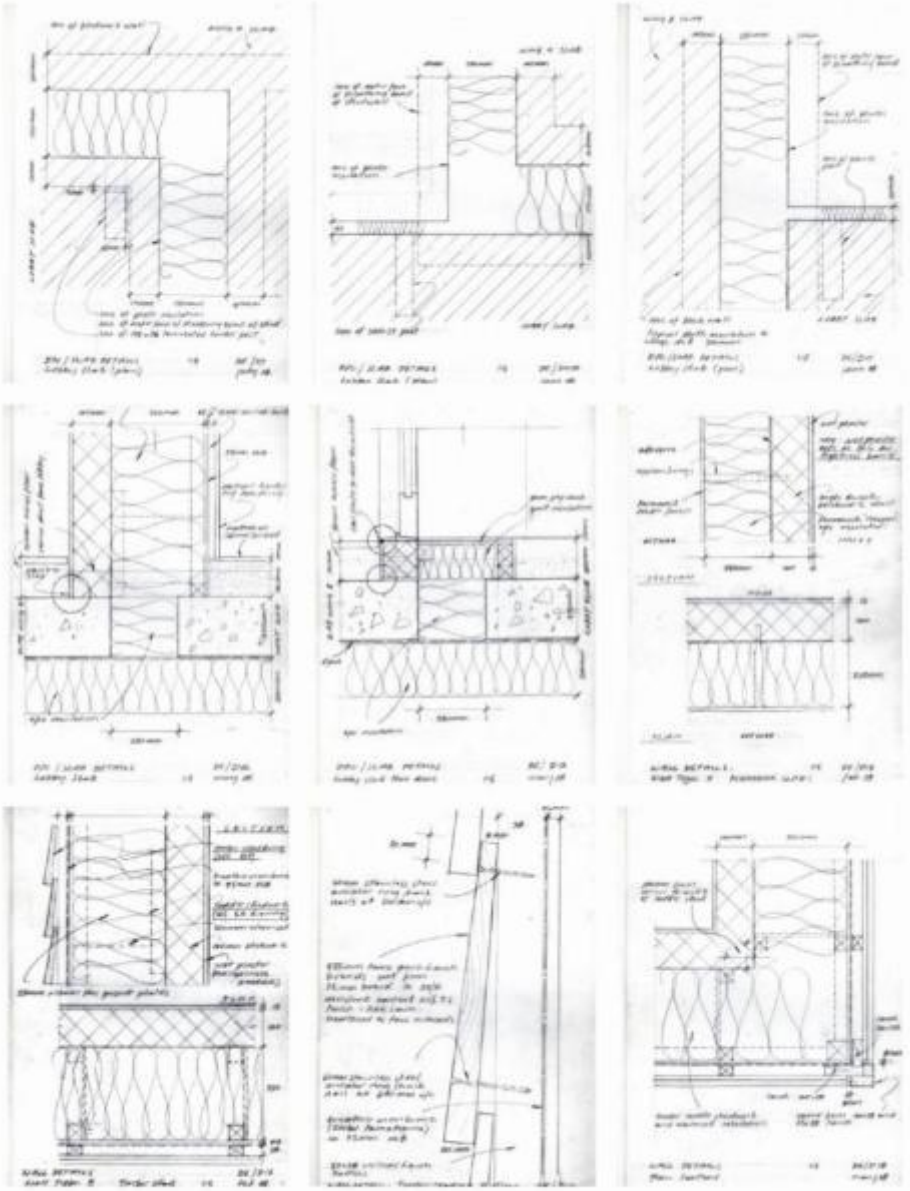

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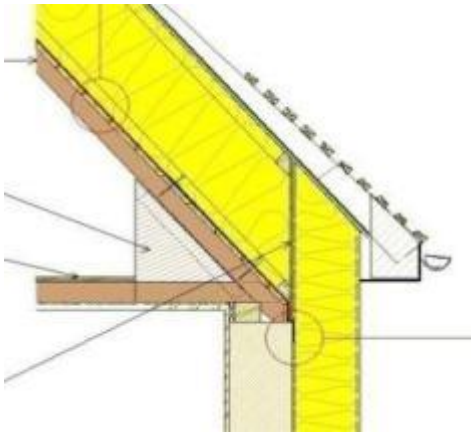
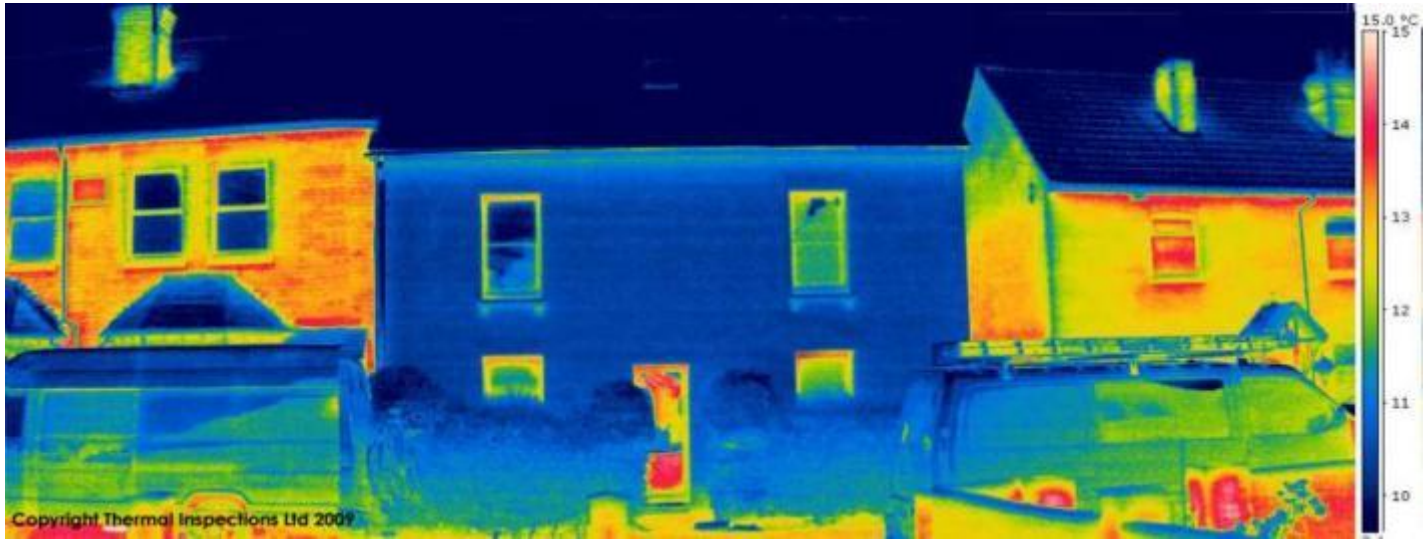
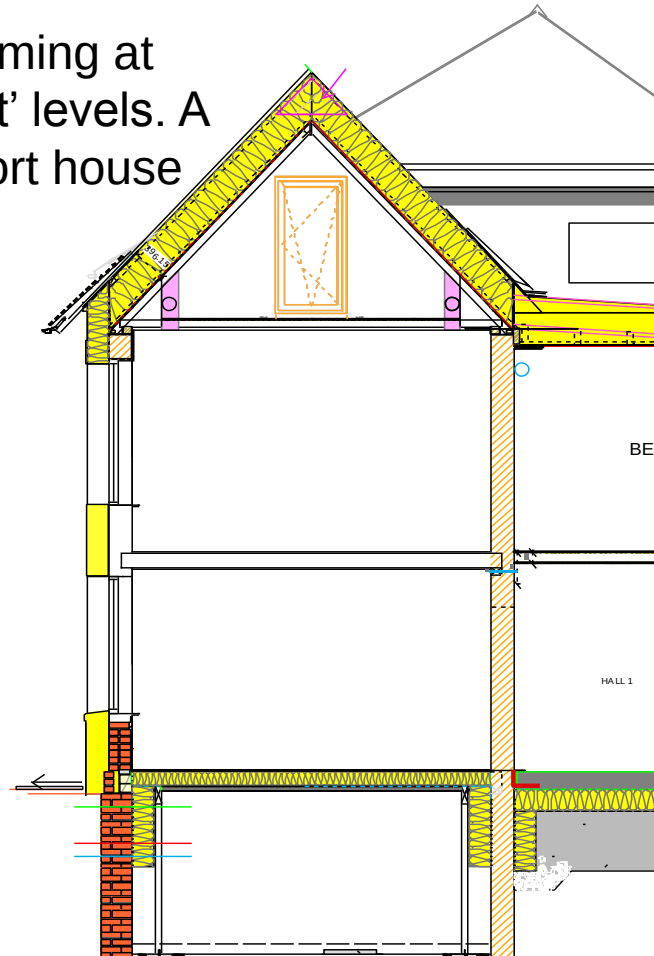


Grove Cottage.
Designed and performing at Passivhaus ‘Enerphit’ levels. A low energy Hi-Comfort house





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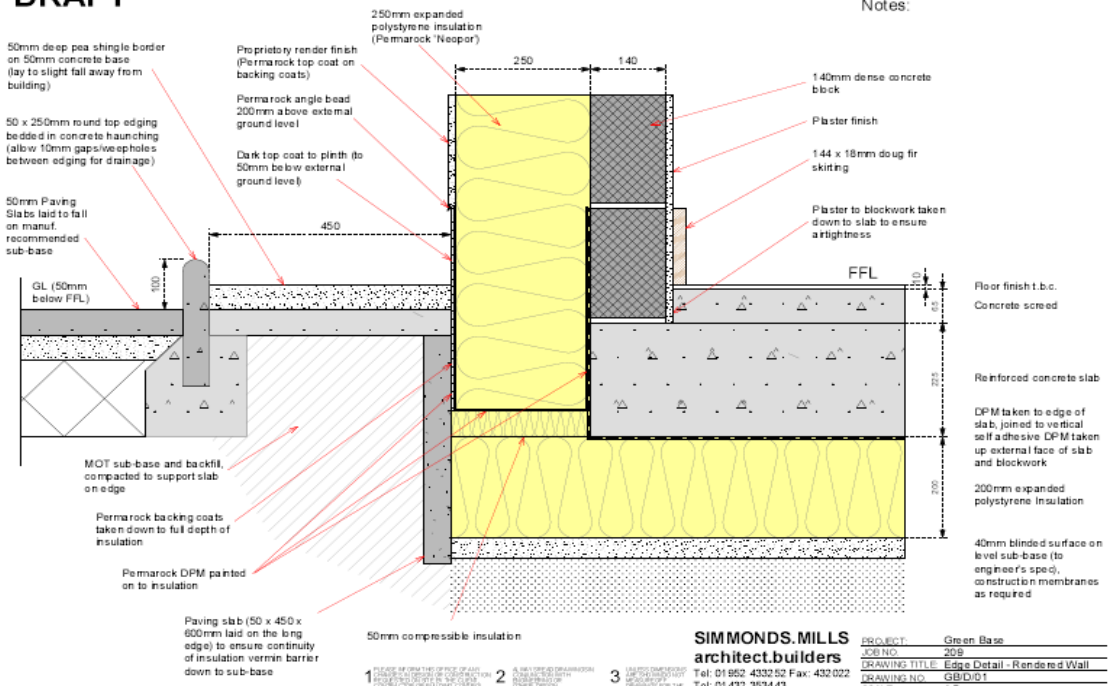
DRAFT

Notes: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FFL
GL (50mm below FFL)
100
210
Floor finish t.b.c.
Concrete screed
Reinforced concrete slab
DPM taken to edge of slab, joined to vertical self adhesive DPM taken up external face of slab and blockwork
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40mm blinded surface on level sub-base (to engineer's spec), construction membranes as required
Paving slab (50 x 450 x 600mm laid on the long edge) to ensure continuity of insulation vermin barrier down to sub-base
50mm compressible insulation

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PROJECT:	Green Base
JOB NO:	209
DRAWING TITLE:	Edge Detail - Rendered Wall
DRAWING NO:	GB/D/01
SCALE:	1:5
DRAWING SIZE:	A3

April 2010

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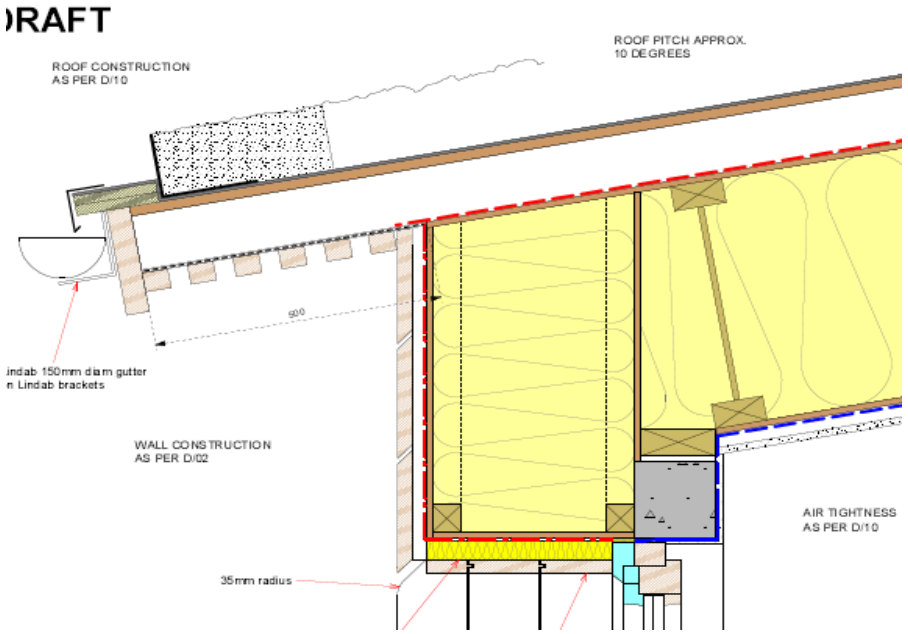
Thermal bridge free construction

Reduce the timber fraction



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Thermal bridge free construction

Relies on thermal integrity too – no gaps in your insulation!

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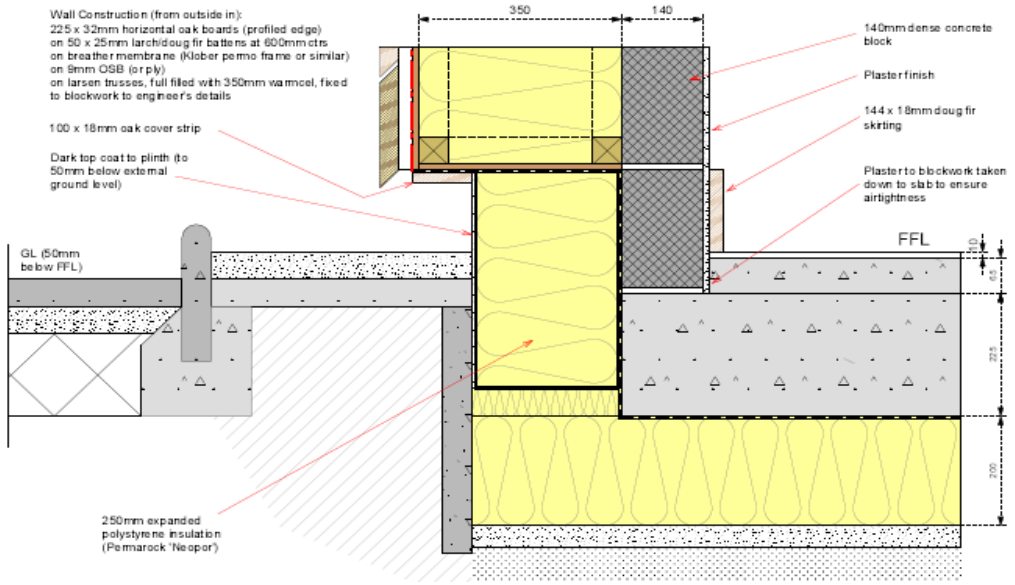
Detail notes as per drawing D/01



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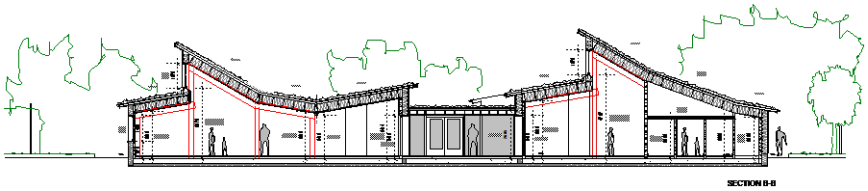
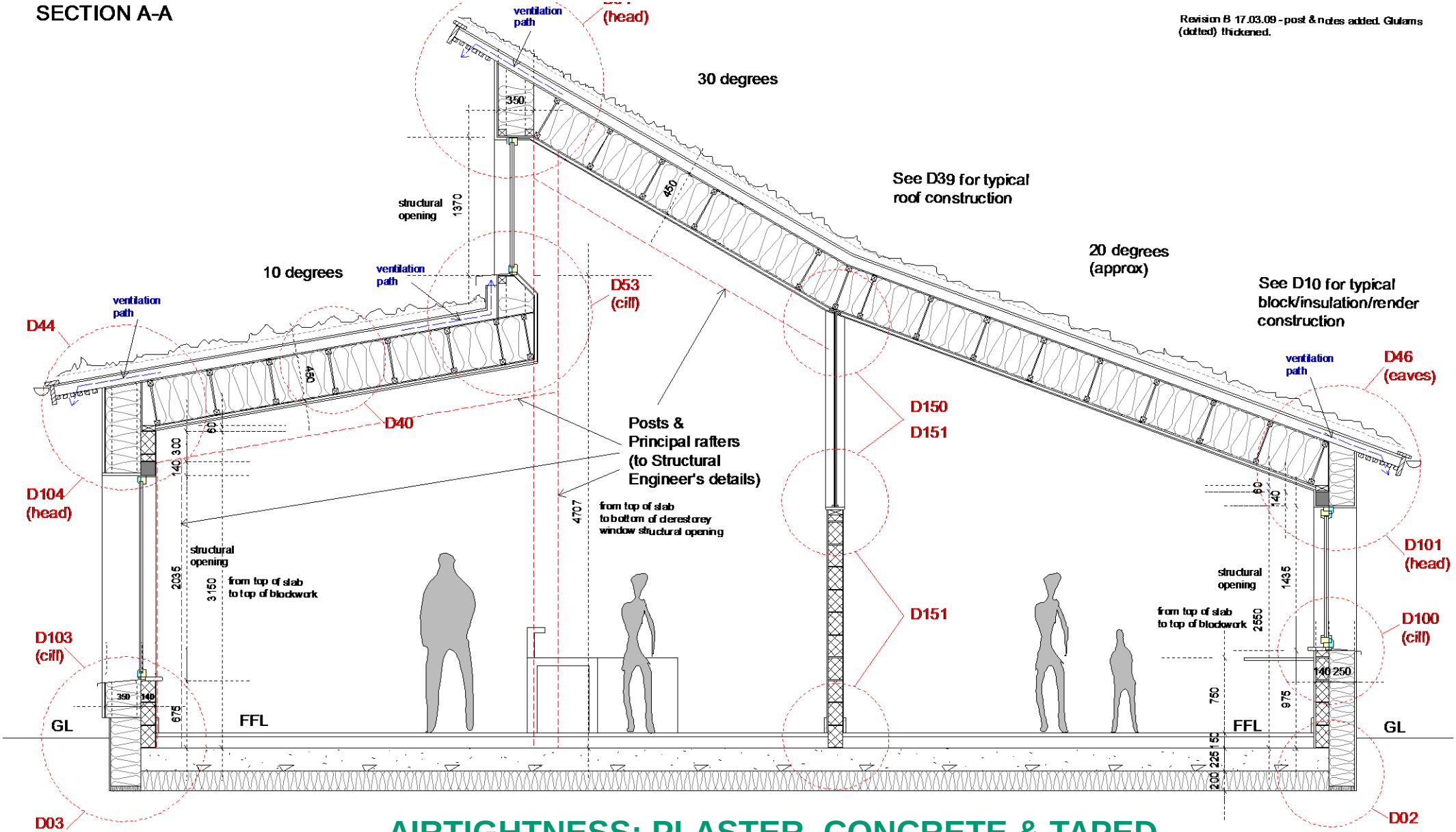


SECTION A-A

Revision B 17.03.09 - post & notes added. Glulams (dotted) thickened.



See D11 for typical block/timber ladder studwork/timber cladding construction

AIRTIGHTNESS: PLASTER, CONCRETE & TAPED MEMBRANE

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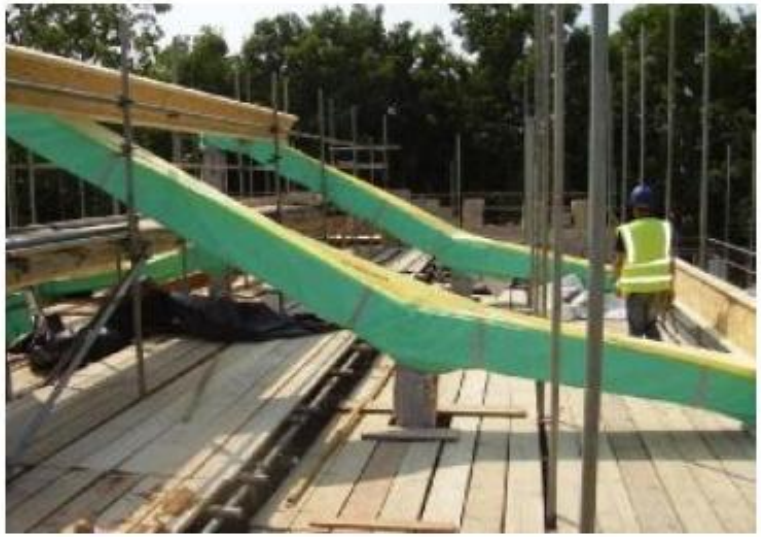

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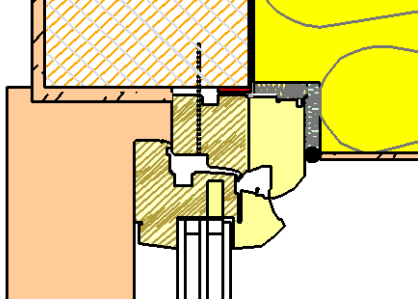
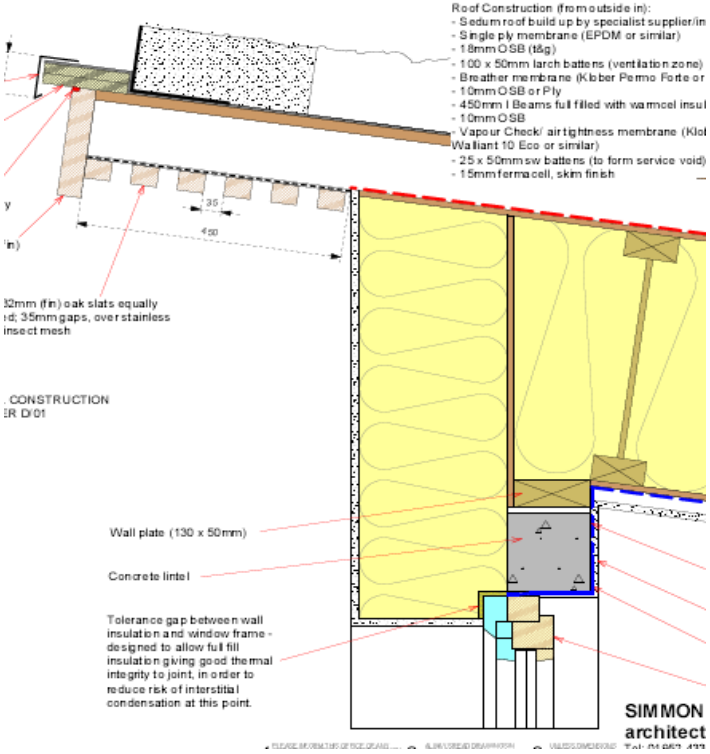
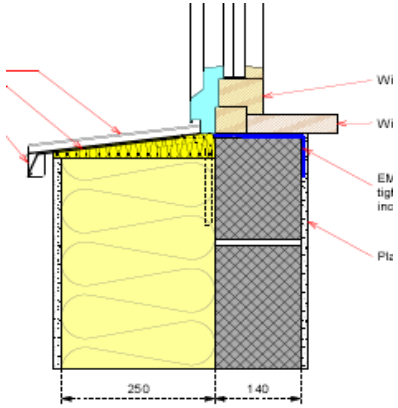



Roof Construction (from outside in):
- Sedum roof build up by specialist supplier/in
- Single ply membrane (EPDM or similar)
- 18mm OSB (t&g)
- 100 x 50mm larch battens (ventilation zone)
- Breather membrane (Klober Permo Forte or
- 10mm OSB or Ply
- 450mm I Beams full filled with warmcel insul
- 10mm OSB
- Vapour Check/ air tightness membrane (Klol Wallant 10 Eco or similar)
- 25 x 50mm sw battens (to form service void)
- 15mm fermacell, skim finish
Wall plate (130 x 50mm)
Concrete lintel
Tolerance gap between wall insulation and window frame - designed to allow full fill insulation giving good thermal integrity to joint, in order to reduce risk of interstitial condensation at this point.
SIMMON
architect



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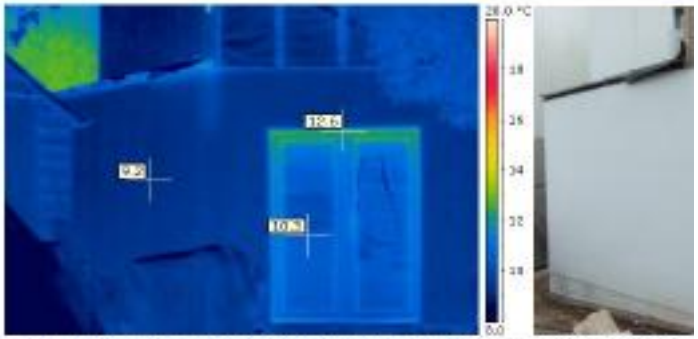
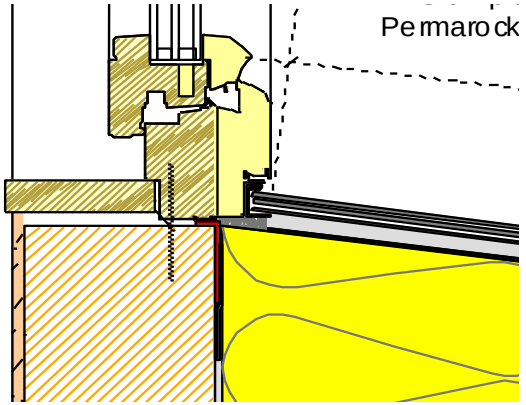
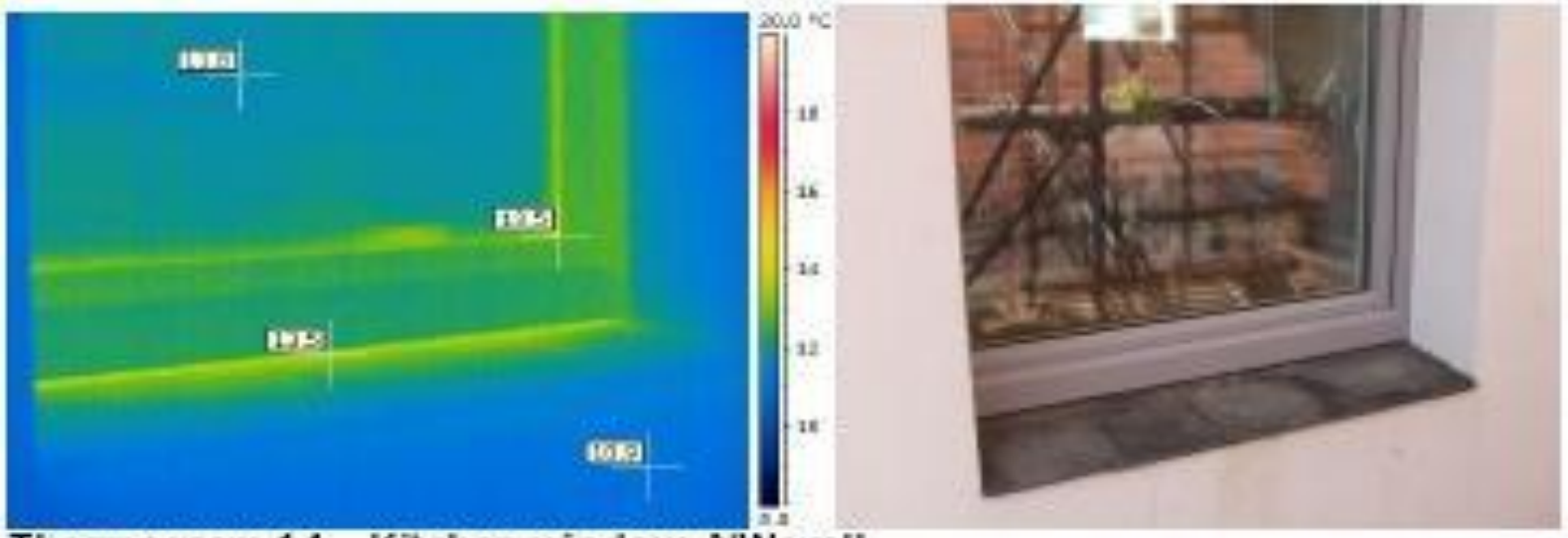


Thermogram 13 – Rear of Grove Cottage, kitchen doors





Thermogram 14 – Kitchen window, NW wall

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Building services

- Heating
- Ventilation
- Hot and cold water
- Lighting

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- Heating
  - Gas boiler and radiators
  - Oversized radiators for low temperature
  - Weather compensation for control and efficiency
  - Thermostatic radiator valves for user control
  - Straightforward technology – not expensive

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• Ventilation

- Mechanical heat recovery ventilation
- Airtight building needs fresh air ventilation system
- Heat recovery needed for passivhaus energy level
- Exposed ductwork
- 3 MVHR units for simple zoning:
  1. Wing A
  2. Training room
  3. Wing B

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- Hot and cold water
  - Gas boiler and solar thermal collector
  - Highly insulated cylinder
  - Microbore distribution
  - Low water use taps
  - 4 litre syphon flush WCs
  - Waterless urinals

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- Lighting
  - Design for daylight – modelled in lighting program
  - Light, high reflectance internal surfaces
  - Electric lighting designed for 300 lux
  - Efficient high light output fittings and T5 tubes – 5.9 W/m² for internal lighting (+0.3 W/m² external)
  - Daylight dimming in communal areas

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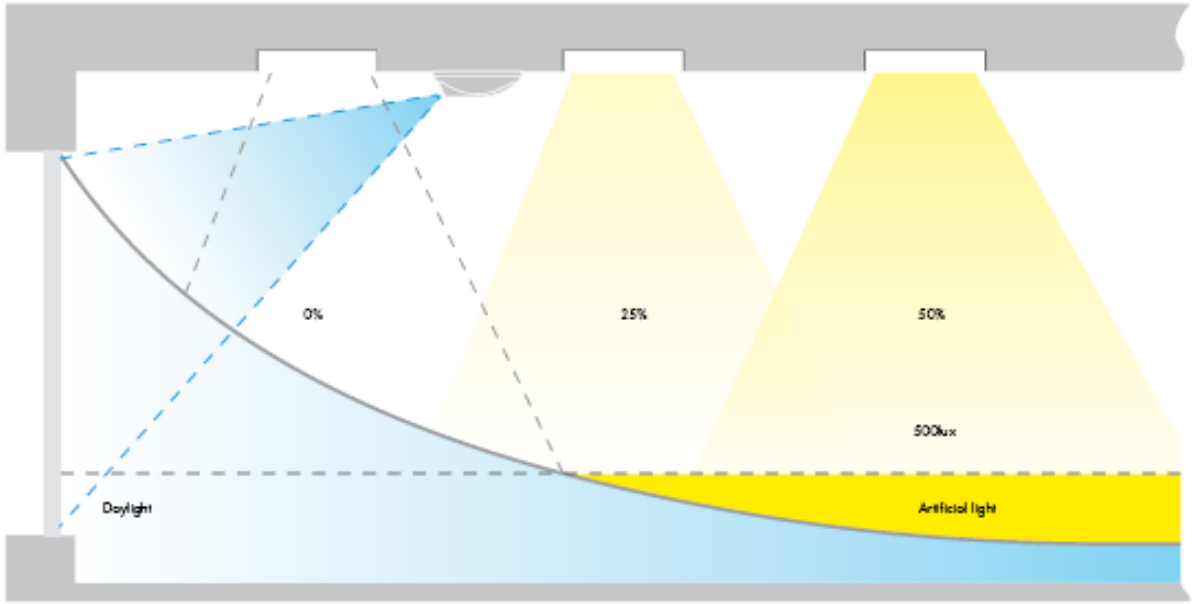
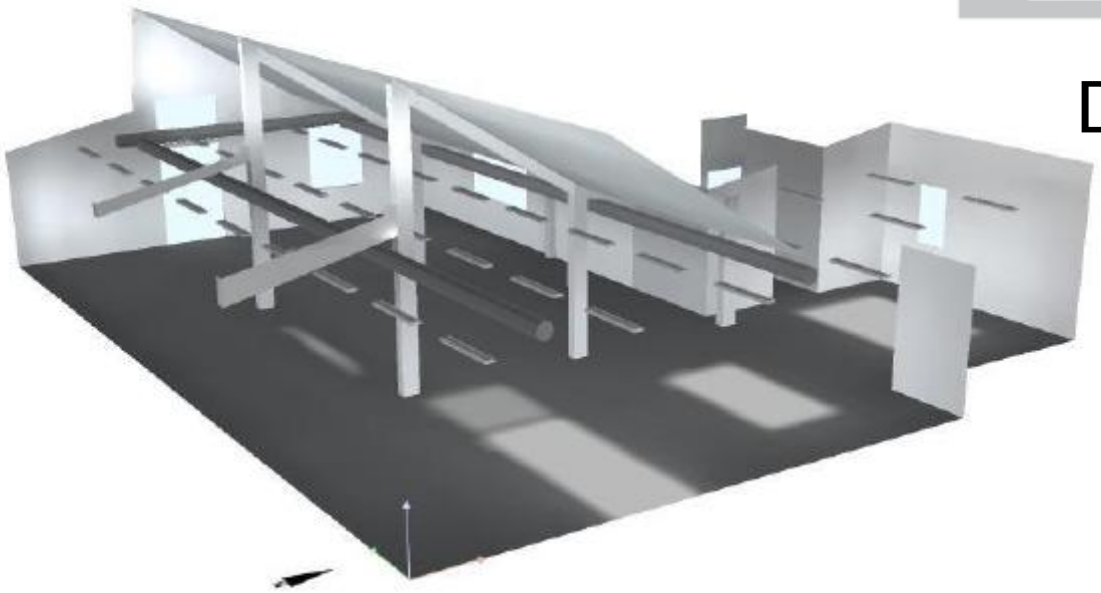


Daylight dimming in large rooms



Integrated daylight and electric lighting design

- Heating / ventilation interlock
  - Problem: the vent system can provide fresh air cooling at the same time as the heating is on
    - *Sunny winter day → fresh air cooling*
    - *Cold air in through vents → turn the heating up*
    - *Even more cold air in…*

    Result: discomfort + high energy consumption

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- Solution: one overall controller
  - This provided by ventilation controls – designed for duct heater, but here controls radiator zone valve
    - *Winter – vent controls set to "heating on" - won't provide fresh air cooling (summer bypass)*
    - *Summer – manual switch to "heating off" – ventilation bypasses heat recovery when warm*

T-intake : 08.0°C
T-supply : 18.5°C
T-heat : 12.0°C
T-exhaust : 11.0°C
T-outside : 07.0°C
PAUL

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The outakes - bits that didn't go quite right

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The outakes - bits that didn't go quite right

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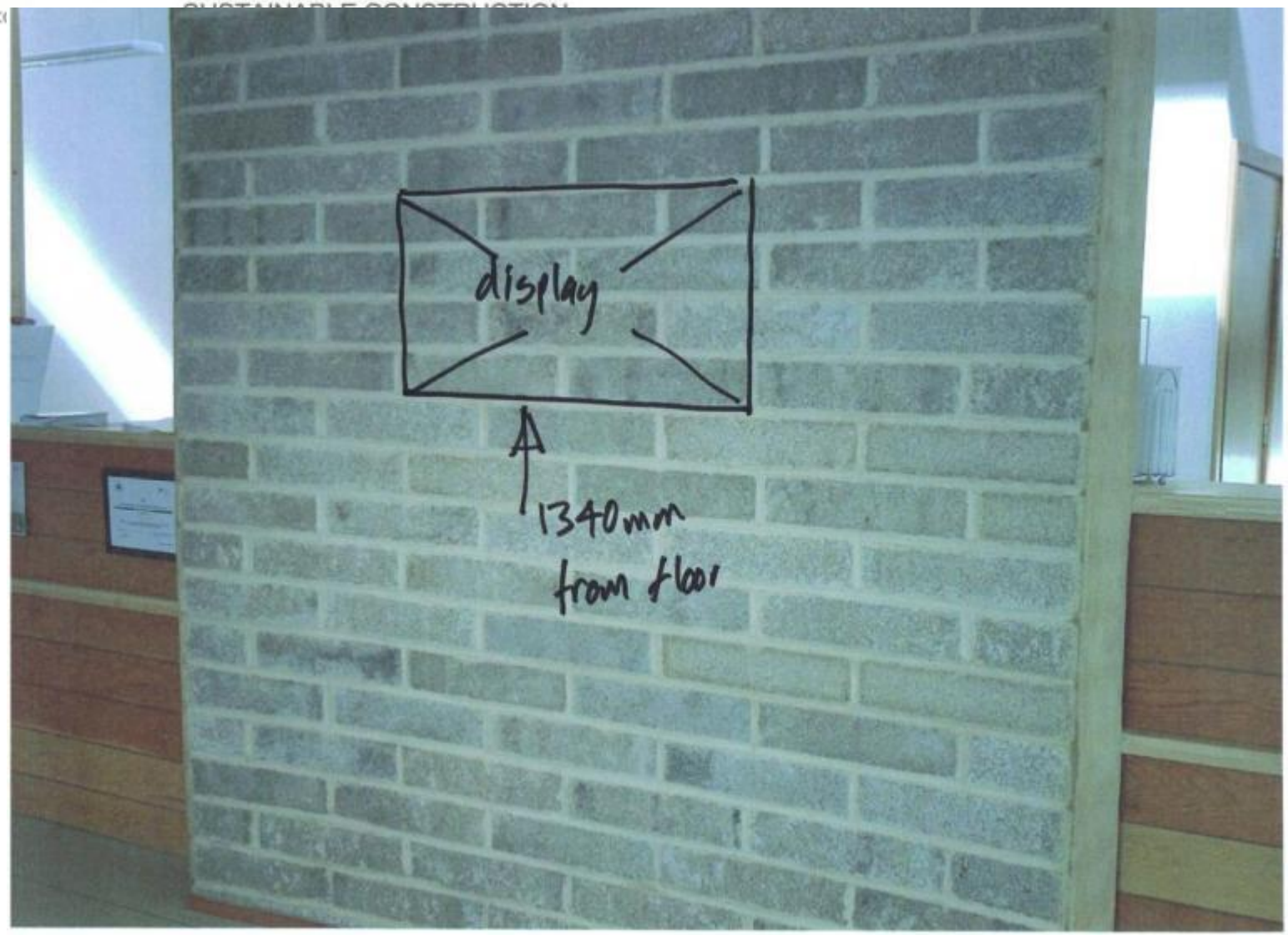
display
1340mm
from floor

- Problems in use
  - Drying out – the heating energy needed to dry out a just-completed wet plastered masonry structure is far more than Passivhaus heat loss
  - High electrical use – by tennants' IT and office equipment

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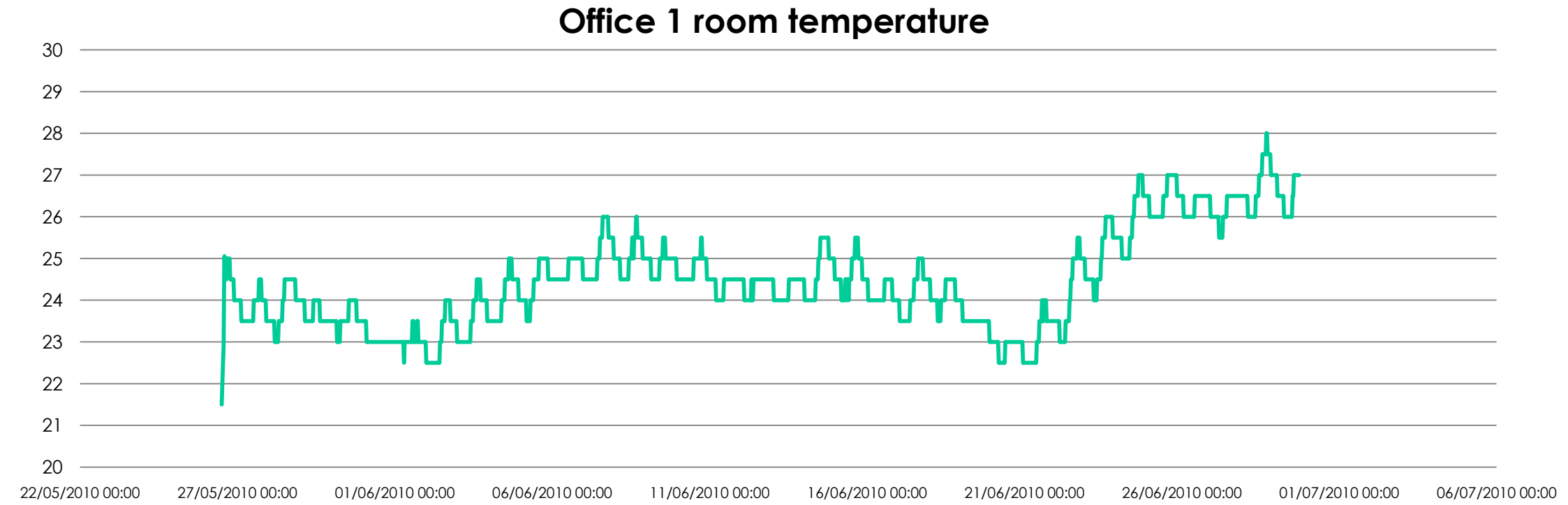
- MVHR is NOT air conditioning
  - Daily swing 1.5-2C, but temp creeps up each day
  - Without night cooling this building can overheat



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- What about next time?
  - Radiators again – that was easy!
  - Simpler boiler controls
  - Combi hot water – don't use much at all
  - Simpler vent controls – and CO_2 speed control
  - No daylight dimming of lighting – just auto-off
  - ALL south windows shaded
  - Write user manual BEFORE users move in

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AECB
the sustainable building association
Learning together, leading by example, lobbying for change

Passivhaus Trust
The UK Passive House Organisation

University of Strathclyde Glasgow

Good Homes Alliance

Sustainable Development Foundation

International PASSIVE HOUSE Association
iPHA

GRADUATE SCHOOL OF THE ENVIRONMENT
YSGOL GRADDEDIGION YR AMGYLCHEDD

passnet

WARM: low energy building practice

Technology Strategy Board
Driving Innovation

RfF Competition
http://tinyurl.com/36h3fv6
AECB/TSB low energy buildings database
http://www.retrofitforthefuture.org/

'Less is More – secure energy after oil'

ZEROCARBONBRITAIN
A NEW ENERGY STRATEGY

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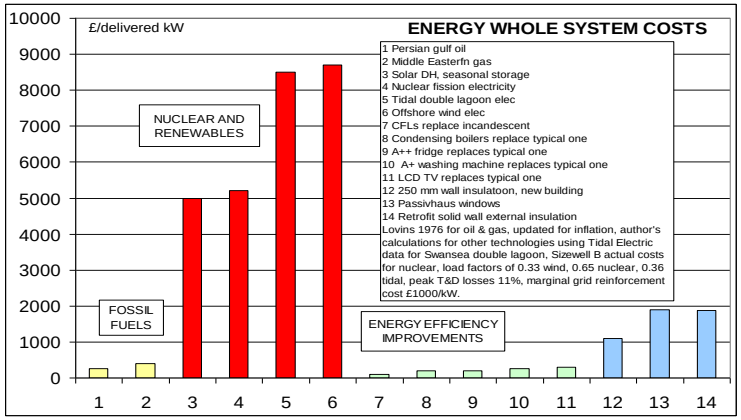
Less Is More?

AECB report - in preparation *(working with CAT to explore further issues raised in Zero Carbon Britain)*

- A sustainable and secure energy future after oil - using less energy, more productively.
- Climate change policy. What must we do to return atmospheric CO2 levels to 350 ppm and safeguard world climate?
- The UK has had its peak coal, oil and gas. What next?
- How do the costs of different future energy systems, including energy efficiency, compare to fossil fuels (a bench mark for the economics of the energy transition)?
- The coming age of scarcity; why we must arguably plan for an absolute decline in energy availability.
- Increased energy productivity; what has the UK achieved, what must it achieve? Thermodynamic realities.
- Changes needed to UK energy policy to deliver a sustainable *and affordable* energy system.


£/delivered kW
ENERGY WHOLE SYSTEM COSTS
1 Persian gulf oil
2 Middle Easterfn gas
3 Solar DH, seasonal storage
4 Nuclear fission electricity
5 Tidal double lagoon elec
6 Offshore wind elec
7 CFLs replace incandescent
8 Condensing boilers replace typical one
9 A++ fridge replaces typical one
10 A+ washing machine replaces typical one
11 LCD TV replaces typical one
12 250 mm wall insulatoon, new building
13 Passivhaus windows
14 Retrofit solid wall external insulation
Lovins 1976 for oil & gas, updated for inflation, author's calculations for other technologies using Tidal Electric data for Swansea double lagoon, Sizewell B actual costs for nuclear, load factors of 0.33 wind, 0.65 nuclear, 0.35 tidal, peak T&D losses 11%, marginal grid reinforcement cost £1000/kW.
NUCLEAR AND RENEWABLES
FOSSIL FUELS
ENERGY EFFICIENCY IMPROVEMENTS
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14

SOME EXPECTATION MANAGEMENT

Do we really appreciate:

1. *How* easy and cheap it has been to industrialise using such accessible, high grade, powerfully energy rich fuel sources, such as wood, coal, gas and oil?
2. The dangers of 'obsessing on supply side' thinking: i.e., that we appear to be up against the laws of physics by hoping that we can maintain our existing type of growth economy mainly by replacing cheap energy rich fossil fuels with renewable energy supply technologies, which can't deliver anywhere near the same amount of power per unit of Gross Domestic Product as fossil fuels have done?
3. The realities of nuclear fission 'saving the day' (?) – as globally limited by uranium suppliy?

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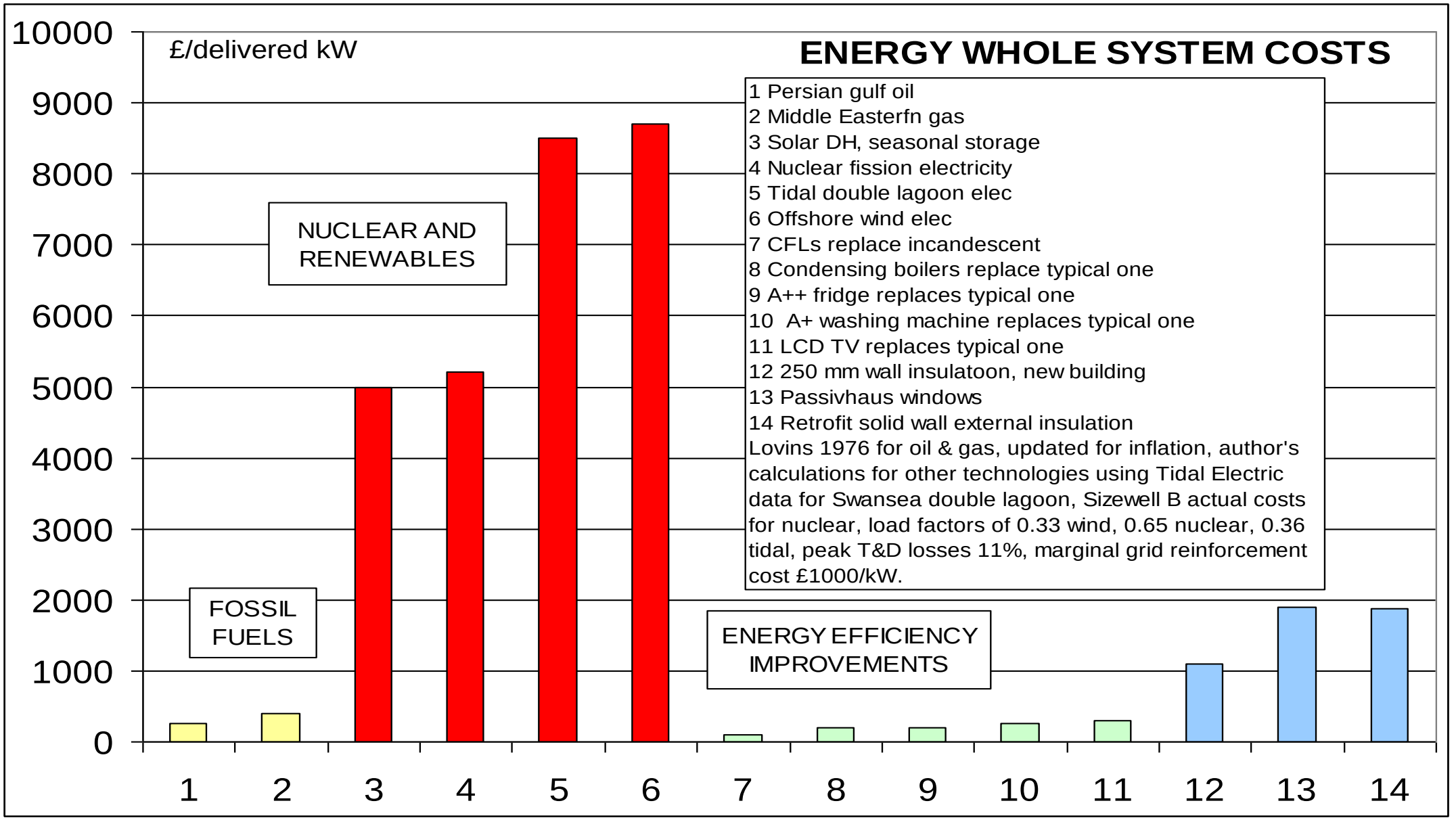
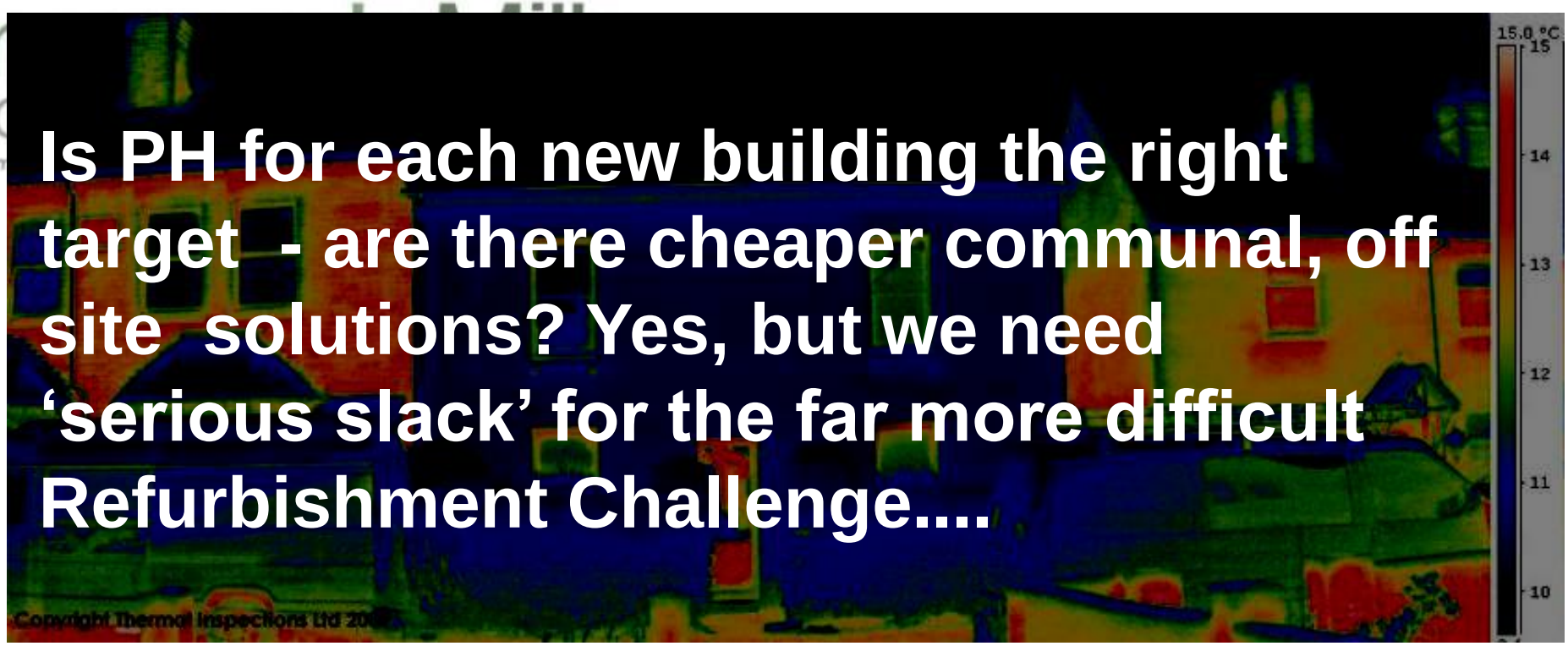


What exactly is the challenge ....

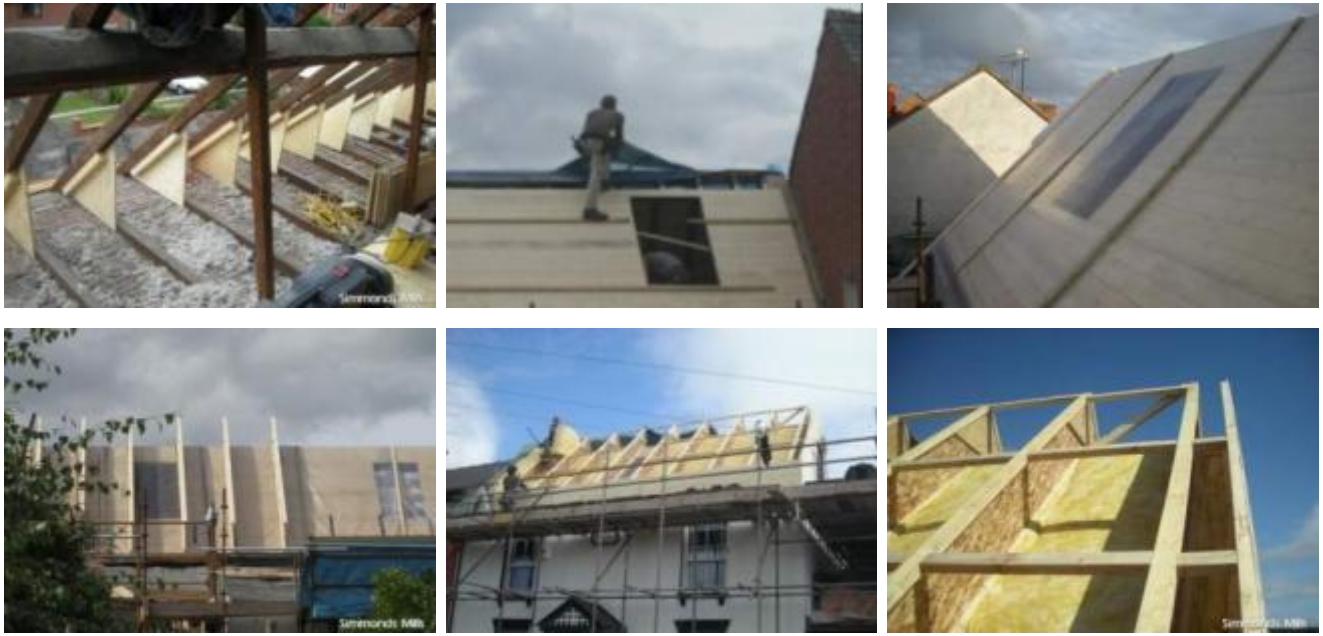
We are working in the absence of an integrated UK energy policy

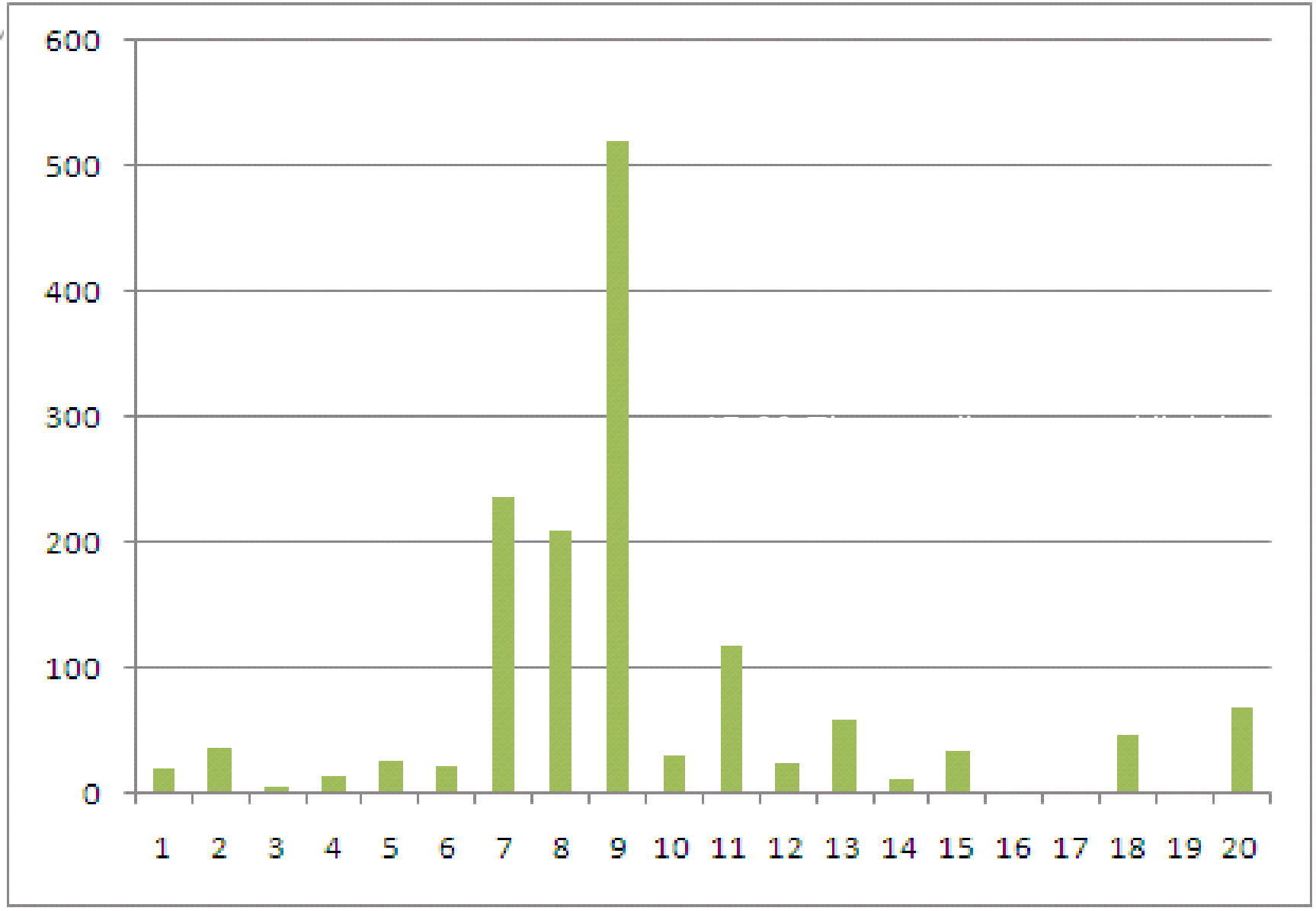
We realise that for most countries decisions on how they heat and power their existing building stock is **pivotal** for achieving energy security, social cohesion and climate change mitigation and adaptation.

- Denmark has an integrated vision and it seems credible that they can phase out fossil fuels by 2030 – UK vision is currently far less credible....



Is PH for each new building the right target - are there cheaper communal, off site solutions? Yes, but we need 'serious slack' for the far more difficult Refurbishment Challenge....




600
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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

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- Unlike new supply, many energy efficiency measures studied to date compete with the resource cost of oil, let alone the market price of oil. *Opportunities are being missed.*

- Lavish, but selective, investment in energy efficiency could keep annual costs at acceptable levels, despite the rise in energy supply costs per kWh.

- We need to give energy efficiency priority over more costly options, otherwise we shall face great economic difficulties..

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Drop incentives for (?):

- Individual air source electric heat pumps
- Gas micro CHP
- Micro-wind on roofs - largely discredited
- Solar thermal on small house roofs - never pays back versus mains gas cond. boiler.
- Biomass boilers on UK wide scale - appear a good way to make climate change worse and reverse years of important public health improvements - many more valuable uses for a limited fuel.
- Burning biomass in power stations

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More support for solid, sound, proven measures

Energy efficiency

•Insulation beyond Bldg Regs - or better still make the regulations AECB Silver moving to Passivhaus in time
•Retrofit insulation where cost-effective against the heat supply method
•Draughtproofing (new UK construction worse than pre-War Swiss, German and Swedish buildings - failure to issue guidance to industry on how the continental countries make buildings so tight)
•Gas (and biomethane) CHP
•MEV (all one needs in buildings which are heated by waste heat)
•MVHR (in buildings heated by unavoidably expensive heat sources)

Cheap renewables

•Passive solar heat (see the Canadian graph)
•Daylighting
•District-scale solar thermal (can crane into place, costs 20-25% as much per kWh and UK can meet decent renewable heat targets quickly)
•Geothermal (Southampton built its geothermal system without government help, £4M at today's prices, most wells have a better yield - many UK aquifers should be investigated and exploited if possible; e.g. Bath, Worcester/Droitwich, Belfast/Larne, Hartlepool/Teesside, Scotland Central Belt, etc.)

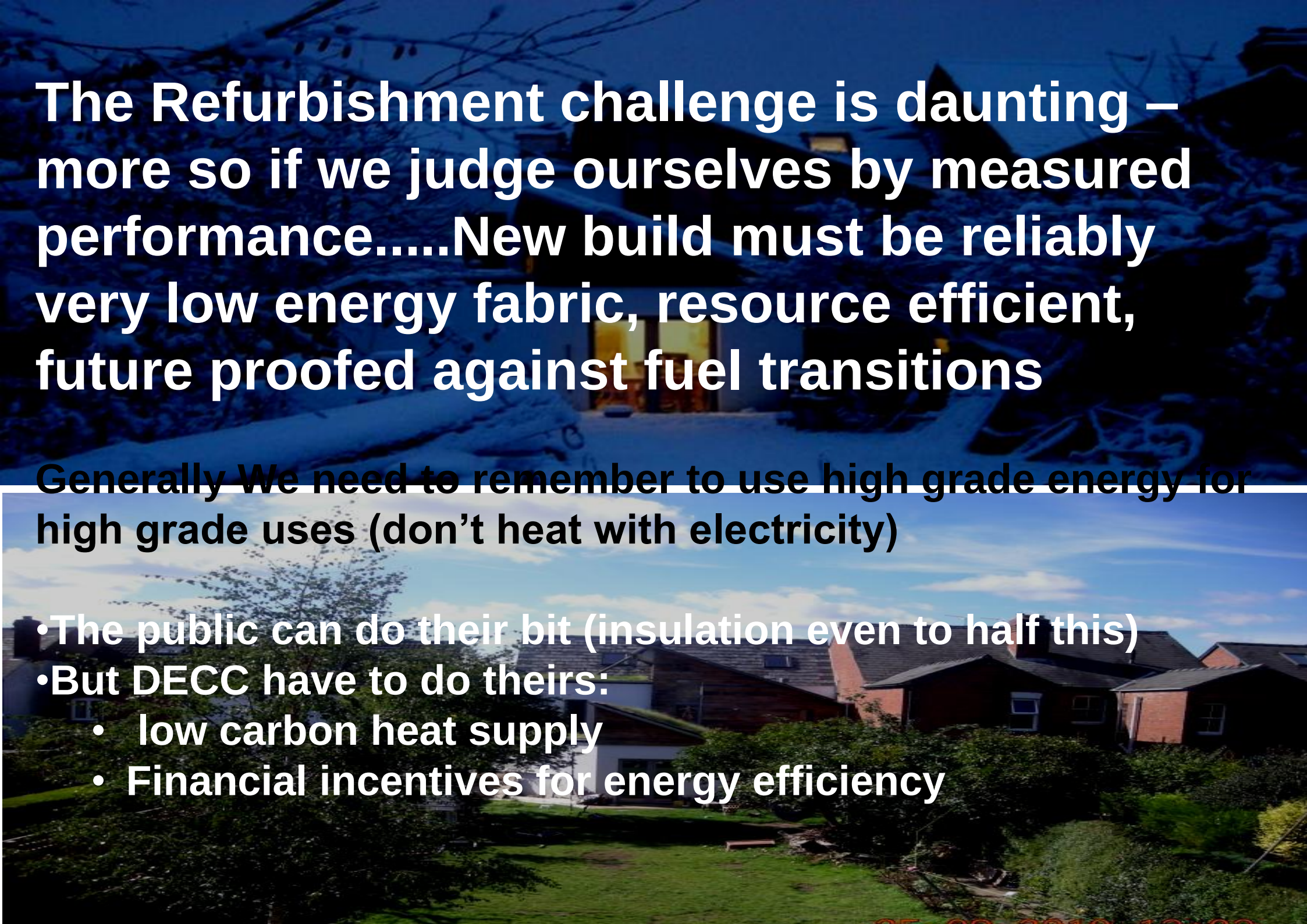
small hydro

occasionally, just maybe, PV.

occasionally, individual ground source electric heat pumps. – outside gas supply area

very large ones electric ground source heat pumps on DH systems

Solar thermal worth considering off gas grid if combined with oil / LPG condensing boilers, solar backed up by stored fuel gives lower CO2 emissions (kg/ kWh heat) than a ground source heat pump.



The Refurbishment challenge is daunting – more so if we judge ourselves by measured performance.....New build must be reliably very low energy fabric, resource efficient, future proofed against fuel transitions

Generally We need to remember to use high grade energy for high grade uses (don't heat with electricity)

- **The public can do their bit (insulation even to half this)**
- **But DECC have to do theirs:**
  - **low carbon heat supply**
  - **Financial incentives for energy efficiency**

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What might the 'communal approach' look like?

opportunities for field scale solar thermal and heat storage to feed into Herefords heat grid?

Park
- large scale ground source heat pumps feeding into community CHP?

Biomethane from sewage works
- CHP for heat and power already running for benefit of Utility
- whose poo is it anyway?

Traffic
More...
Map
Satellite
2000 ft
Imagery ©2010 DigitalGlobe, Infoterra Ltd & Bluesky, GeoEye, Getmapping plc, Bluesky, Infoterra Ltd & COWI A/S - Term

field scale solar thermal to feed heat grid?

Biogas produced from forestry, farming and kitchen waste burnt in communal CHP plant
+ contributions from large scale solar thermal from large array of panels fitted to industrial units roofs?